

Appendix C, Part 4

Chemical Properties Data

Chemical Summary for . . .

SODIUM CHLORIDE

SODIUM CHLORITE

SODIUM HYDROXIDE

SODIUM HYPOPHOSPHITE

SODIUM HYPOPHOSPHITE 1-HYDRATE

SODIUM PERSULFATE

SODIUM SULFATE

STANNOUS CHLORIDE AND STANNOUS CHLORIDE AS TIN

SULFURIC ACID

TARTARIC ACID

TETRASODIUM EDTA (Na₄EDTA)

TRIETHANOLAMINE

SODIUM CITRATE

VANILLIN

CITED REFERENCES

ATTACHMENT C-1 (Standard References Searched)

CHEMICAL SUMMARY FOR SODIUM CHLORIDE

This chemical was identified by one or more suppliers as a bath ingredient for the tin-palladium process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium chloride are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM CARBONATE		
Characteristic/Property	Data	Reference
CAS No.	7647-14-5	
Common Synonyms	table salt, rock salt, sea salt, halite	Budavari et al. 1996; HSDB 1996
Molecular Formula	NaCl	Budavari et al. 1996
Chemical Structure	Cl - Na	Budavari et al. 1996
Physical State	Cubic white crystals, granules, or powder, colorless and transparent or translucent when in large crystals	Budavari et al. 1996
Molecular Weight	58.44	Budavari et al. 1996
Melting Point	804 °C, 801 °C, 804-1600 °C	Budavari et al. 1996; Chapman and Hall 1996; Perry et al. 1994
Boiling Point	1413 °C	Chapman and Hall 1996
Water Solubility	1 g/2.8 mL water @ 25 °C 35.7 g/100 cm ³ @ 0 °C 39.12 g/100 cm ³ @ 100 °C	Budavari et al. 1996; Chapman and Hall 1996; Lide 1991
Density	2.165 g/mL @ 25 °C	Lide 1991
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow} (= Log P _{oct})	no data	
Vapor Pressure	1 mm Hg @ 865 °C	Sax and Lewis 1989
Reactivity	Reacts violently with BrF ₃ and lithium.	Sax and Lewis 1989
Flammability	non-flammable	NTP 1996
Flash Point	non-combustible	HSDB 1996
Dissociation Constant	no data	
Air Diffusivity Constant	no data	
Molecular Diffusivity Constant	no data	
Henry's Law Constant	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	no data	
Conversion Factors	no data	

II. ENVIRONMENTAL FATE

A. Environmental Release

Sodium chloride (NaCl) occurs in nature as the mineral halite (i.e. salt deposits) and is dissolved in the ocean (2.6% concentration) and other bodies of water (HSDB 1996). It is produced by mining, evaporation of brine from underground salt deposits, and evaporation from sea water (Budavari et al. 1996). It is released artificially into the environment as waste from bake houses and pickling and canning factories, etc., and in its use as a snow antifreeze or de-icer on pathways (HSDB 1996).

B. Transport

No information was found on the environmental transport of sodium chloride in the secondary sources searched. Its high water solubility (1 g/2.8 mL water @ 25 °C, Budavari et al. 1996) suggests that if it were released into the soil it would be highly mobile (e.g. when dissolved in rainfall) and could eventually end up in the groundwater.

C. Transformation/Persistence

1. Air — No information was found on the transformation/persistence of sodium chloride in air in the secondary sources searched. Its low reactivity and volatility (HSDB 1996, Sax and Lewis 1989) and high water solubility (Chapman and Hall 1996) indicate that any sodium chloride released into the air (e.g. from salt mining) would either dissolve in air moisture or remain as unchanged particulates that settle out.
2. Soil — Sodium chloride is found naturally in the soil as underground rock salt deposits. These salt deposits can be dissolved in water because NaCl is highly water soluble (Chapman and Hall 1996, Lide 1991). The dissolved sodium chloride can then be either recovered above ground, as in solution mining (Perry et al. 1994), or may possibly end up in the groundwater (further information was not located in the searched secondary sources).
3. Water — Sodium chloride is very soluble in water, being stable in solution for at least 24 hours at room temperature (NTP 1996, Chapman and Hall 1996, Lide 1991). No other relevant information was located in the secondary sources searched.
4. Biota — No information was found on the transformation/persistence of sodium chloride in the biota in the secondary sources searched. Its high water solubility indicates that it would not appreciably bioconcentrate in the flora or fauna.

CHEMICAL SUMMARY FOR SODIUM CHLORITE

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper and non-formaldehyde electroless copper processes. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium chlorite are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM CHLORITE		
Characteristic/Property	Data	Reference
CAS No.	7758-19-2	
Common Synonyms	chlorous acid, sodium salt; Textone	HSDB 1995
Molecular Formula	ClNaO ₂	Budavari et al. 1989
Chemical Structure	NaClO ₂	Budavari et al. 1989
Physical State	slightly hygroscopic crystals or flakes	Budavari et al. 1989
Molecular Weight	90.45	Budavari et al. 1989
Melting Point	decomposes at 180-200°C	Budavari et al. 1989
Boiling Point	no data	
Water Solubility	390 g/L at 17°C; 550 g/L at 60°C	Budavari et al. 1989
Density	2.468 g/m ³	HSDB 1995
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow}	no data	
Vapor Pressure	negligible	Eastman Kodak 1986
Reactivity	powerful oxidizer, but will not explode on percussion unless in contact with oxidizable material; in aqueous alkaline solution, chlorite ion is very stable; in acid solution, chlorite forms chlorous acid (HClO ₂), which rapidly forms chlorine dioxide (ClO ₂), chlorate, and chloride	Budavari et al. 1989
Flammability	fire hazard rating = 1; slightly combustible	IARC 1991 Lockheed Martin 1994c
Flash Point	no data	
Dissociation Constant	no data	
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	no data	
Conversion Factors	not applicable	

II. ENVIRONMENTAL FATE

A. Environmental Release

Most of the sodium chlorite used in the U.S. is in the production of aqueous chlorine dioxide solutions at the site of use. The conversion can be carried out by the disproportionation of chlorous acid formed from chlorite in aqueous hydrochloric acid solution, but is more commonly achieved by the oxidation of chlorite by chlorine or hypochlorous acid (IARC 1991). Chlorine dioxide is generated to bleach and strip textiles; to bleach wood pulp in paper processing; to eliminate tastes and odors in drinking water; to reduce loads of adsorbable organic halogenated compounds in industrial effluents; to control microbiological growth in paper mills, oil wells, petroleum systems, and food processing flume water; to bleach fats and oils; to disinfect sewage; to treat factory wastes;

to bleach natural foliage; and to control algae in industrial cooling towers. Sodium chlorite is also used in the electronics industry for etching. It is not known to occur naturally (IARC 1991).

Sodium chlorite is used in a small number of water treatment plants to generate chlorine dioxide; this may result in a low residual concentration of chlorite in drinking water (IARC 1991). Sodium chlorite is not listed on U.S. EPA's TRI, requiring certain U.S. industries to report on chemical releases to the environment (TRI93 1995).

B. Transport

No information on the transport of sodium chlorite was found in the secondary sources searched.

C. Transformation/Persistence

No information on the transformation/persistence of sodium chlorite was found in the secondary sources searched.

CHEMICAL SUMMARY FOR SODIUM HYDROXIDE

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper, conductive polymer, non-formaldehyde electroless copper, and tin-palladium processes. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium hydroxide are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM HYDROXIDE		
Characteristic/Property	Data	Reference
CAS No.	1310-73-2	
Common Synonyms	caustic soda; soda lye	Budavari et al. 1989
Molecular Formula	NaOH	Budavari et al. 1989
Chemical Structure	NaOH	Budavari et al. 1989
Physical State	deliquescent solid	Lide 1991
Molecular Weight	40.01	Budavari et al. 1989
Melting Point	318°C	Budavari et al. 1989
Boiling Point	1390°C	Lide 1991
Water Solubility	1 g in 0.9 mL water, 0.3 mL boiling water	Budavari et al. 1989
Density	2.13 g/mL @ 25°C	Budavari et al. 1989
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow}	too low to be measured	HSDB 1995
Vapor Pressure	1 mm Hg @ 739°C	Sax 1984
Reactivity	reacts with all mineral acids to form the corresponding salts; with organic acids to form soluble salts; pH of 0.5% solution is about 13	HSDB 1995 Budavari et al. 1989
Flammability	not combustible but solid form in contact with moisture or water may generate sufficient heat to ignite combustible materials	HSDB 1995
Flash Point	no data	
Dissociation Constant	dissociates completely	HSDB 1995
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	odorless	HSDB 1995
Conversion Factors	1 mg/m ³ = 0.61 ppm; 1 ppm = 1.636 mg/m ³	calculated: mg/m ³ = 1 ppm x MW/24.45

II. ENVIRONMENTAL FATE

A. Environmental Release

Sodium hydroxide is a corrosive deliquescent solid available in various solid forms and as solutions, usually 45-75% in water. It is a strong alkali that is highly soluble in water (Budavari et al. 1989). When the chemical is dissolved in water, mists are frequently formed and heat is released (Pierce 1994b). As the least expensive strong base, sodium hydroxide is widely employed in industries such as rayon, cellophane and textiles, pulp and paper, soap and detergents, etching and electroplating, and many others (ACGIH 1991). Although sodium hydroxide releases are expected to occur in industrial/occupational settings, no data were found in the secondary sources searched. Consumers may be exposed to oven cleaning products that contain >5% lye (HSDB 1995).

B. Transport

No information on the transport of sodium hydroxide was found in the secondary sources searched. Because of its low vapor pressure, sodium hydroxide is not expected to partition to the atmosphere in significant amounts. The water solubility suggests that sodium hydroxide would leach through soil.

C. Transformation/Persistence

No information on the transformation/persistence of sodium hydroxide was found in the secondary sources searched. Low vapor pressure and its water solubility suggest the chemical would remain in the aqueous phase.

CHEMICAL SUMMARY FOR SODIUM HYPOPHOSPHITE

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1. The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium hypophosphite are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM HYPOPHOSPHITE		
Characteristic/Property	Data	Reference
CAS No.	7681-53-0	
Common Synonyms	phosphinic acid, sodium salt	Budavari et al. 1989
Molecular Formula	H ₂ NaO ₂ P	Budavari et al. 1989
Chemical Structure	H ₂ -O ₂ -P.Na	RTECS 1995
Physical State	white granules	Budavari et al. 1989
Molecular Weight	87.97	Budavari et al. 1989
Melting Point	no data	
Boiling Point	no data	
Water Solubility	100 g/100 mL at 25 °C	Weast 1983-1984
Density	no data	
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow}	no data	
Vapor Pressure	no data	
Reactivity	explodes when triturated with chlorates or other oxidizing agents; explosive when heated; mixture with sodium or potassium nitrate is powerful explosive	Budavari et al. 1989 HSDB 1995
Flammability	decomposes when heated forming phosphine, a spontaneously flammable gas	HSDB 1995
Flash Point	phosphine is spontaneously flammable	HSDB 1995
Dissociation Constant	no data; aqueous solution is neutral	Budavari et al. 1989
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	odorless	Budavari et al. 1989
Conversion Factors	1 ppm = 3.60 mg/m ³ 1 mg/m ³ = 0.28 ppm	Calculated using: mg/m ³ = ppm × MW/24.45

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found regarding the release of sodium hypophosphite to the environment. The chemical could potentially enter the environment from its use in removing mercury from animal feeds and manures or as an antimicrobial agent in meat, poultry, and fish (HSDB 1995). Sodium hypophosphite is not listed by the TRI requiring certain types of U.S. industries to report environmental releases (TRI93 1995).

B. Transport

No information was found in the secondary sources searched regarding the movement of sodium hypophosphite through environmental media. Based on the high water solubility, the chemical could be expected to be found in the aqueous phase.

C. Transformation/Persistence

No information was found in the secondary sources searched regarding the transformation/persistence of sodium hypophosphite in the air, soil, water, or biota.

CHEMICAL SUMMARY FOR SODIUM HYPOPHOSPHITE 1-HYDRATE

This chemical was identified by one or more suppliers as a bath ingredient for the organic-palladium process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium hypophosphite 1-hydrate are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM HYPOPHOSPHITE 1-HYDRATE

Characteristic/Property	Data	Reference
CAS No.	10039-56-2	
Common Synonyms	sodium phosphinate hydrate; phosphinic acid, sodium salt, monohydrate	Lockheed Martin 1995b
Molecular Formula	H_4NaPO_3	CHEMFINDER 1996
Chemical Structure	$NaH_2PO_2 \cdot H_2O$	CHEMFINDER 1996
Physical State	white crystals	EM Industries 1991
Molecular Weight	105.99	CHEMFINDER 1996
Melting Point	230°C (decomposes)	EM Industries 1991
Boiling Point	no data	
Water Solubility	50% 100 g/100 mL	EM Industries 1991 Chapman and Hall 1995
Density	0.8	EM Industries 1991
Vapor Density (air = 1)	3.6	CHEMFINDER 1996
K_{oc}	no data	
Log K_{ow}	no data	
Vapor Pressure	no data	
Reactivity	react violently with strong oxidizing agents	EM Industries 1991
Flammability	gives off toxic gases when burned	CHEMFINDER 1996
Flash Point	no data	
Dissociation Constant	no data	
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	odorless	JT Baker Inc. 1994
Conversion Factors	no data	

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found in the secondary sources searched on the amount or sources of sodium hypophosphite 1-hydrate released to the environment.

B. Transport

No information was found in the secondary sources searched to indicate how sodium hypophosphite 1-hydrate is transported in the environment. The high water solubility suggests that leaching into groundwater could occur.

C. Transformation/Persistence

No information was found in the secondary sources searched regarding the transformation or persistence of sodium hypophosphite 1-hydrate in air, soil, water, or biota.

CHEMICAL SUMMARY FOR SODIUM PERSULFATE

This chemical was identified by one or more suppliers as a bath ingredient for the carbon, graphite, organic-palladium, and tin-palladium processes. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium persulfate are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM PERSULFATE		
Characteristic/Property	Data	Reference
CAS No.	7775-27-1	
Common Synonyms	sodium peroxydisulfate peroxydisulfuric acid, disodium salt disodium peroxydisulfate	Budavari et al. 1989 RTECS 1995 DuPont and Co. 1992
Molecular Formula	Na ₂ S ₂ O ₈	Budavari et al. 1989
Chemical Structure	Na ₂ O ₈ S ₂	Budavari et al. 1989
Physical State	white crystalline powder	Budavari et al. 1989
Molecular Weight	238.13	Budavari et al. 1989
Melting Point	no data	
Boiling Point	no data	
Water Solubility	549 g/L @ 20°	Budavari et al. 1989
Density	2.4	JT Baker Inc. 1985
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow}	no data	
Vapor Pressure	no data	
Reactivity	gradually decomposes; decomposition promoted by H ₂ O and high temperature strong oxidizer. Contact with other material may cause fire. Can react violently with shock, friction, or heat	Budavari et al. 1989 JT Baker Inc. 1985
Flammability	slightly combustible	Lockheed Martin 1989b
Flash Point	no data	
Dissociation Constant	no data	
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	odorless	JT Baker Inc. 1985
Conversion Factors	1 mg/m ³ = 0.10 ppm 1 ppm = 9.74 mg/m ³	Calculated using: ppm = mg/m ³ × 24.45/mol. wt.

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found in the secondary sources searched regarding the environmental release of sodium persulfate.

B. Transport

No information was found in the secondary sources searched regarding the transport of sodium persulfate.

C. Transformation/Persistence

No information was found in the secondary sources searched regarding the transformation/persistence of sodium persulfate in air, soil, water, or biota.

CHEMICAL SUMMARY FOR SODIUM SULFATE

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium sulfate are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM SULFATE		
Characteristic/Property	Data	Reference
CAS No.	7757-82-6	
Common Synonyms	bisodium sulfate; disodium monosulfate disodium sulfate; sulfuric acid disodium salt	HSDB 1995
Molecular Formula	Na ₂ SO ₄	HSDB 1995
Chemical Structure	H ₂ -O ₄ -S ₂ Na	HSDB 1995
Physical State	white powder or orthorhombic bipyramidal crystals	HSDB 1995
Molecular Weight	142.06	HSDB 1995
Melting Point	888°C	HSDB 1995
Boiling Point	not found	
Water Solubility	soluble in about 3.6 parts H ₂ O	HSDB 1995
Density	2.671	HSDB 1995
Vapor Density (air = 1)	not found	
K _{OC}	not found	
Log K _{OW}	not found	
Vapor Pressure	not found	
Reactivity	sodium sulfate and aluminum will explode at 800°C; reacts violently with magnesium	HSDB 1995
Flammability	not found	
Flash Point	nonflammable	HSDB 1995
Dissociation Constant	not found	
Henry's Law Constant	not found	
Molecular Diffusivity Coefficient	not found	
Air Diffusivity Coefficient	not found	
Fish Bioconcentration Factor	not found	
Odor Threshold	odorless	HSDB 1995
Conversion Factors	1 ppm = 5.81 mg/m ³ 1 mg/m ³ = 0.172 ppm	Calculated using: ppm = mg/m ³ x 24.45/m.w.

II. ENVIRONMENTAL FATE

A. Environmental Release

Sodium sulfate occurs in nature in the minerals mirabilite, thenardite, hanksite, sulphohalite, galubzrite, loeweite, ferronatrite, bloedite, tychite, apthitalite, tamarugite, and mendozite; it is relatively common in alkali lakes, ground water, and sea water (HSDB 1995).

An analysis of individual droplets in samples of fog, haze and cloud collected in Israel revealed the presence of both acid and alkaline droplets (Ganor et al. 1993). The alkaline droplets contained minerals and salt solutions of sodium sulfate, calcium sulfate or sodium chloride.

B. Transport

No information was found in the secondary sources searched regarding the environmental transport of sodium sulfate.

C. Transformation/Persistence

1. Air — No information was found in the secondary sources searched regarding the transformation/persistence of sodium sulfate in air. HSDB (1995) states that sodium sulfate may persist indefinitely in the environment.
2. Soil — No information was found in the secondary sources searched regarding the transformation/persistence of sodium sulfate in soil. HSDB (1995) states that sodium sulfate may persist indefinitely in the environment.
3. Water — No information was found in the secondary sources searched regarding the transformation/persistence of sodium sulfate in the aquatic environment. HSDB (1995) states that sodium sulfate may persist indefinitely in the environment.
4. Biota — There is no evidence that sodium sulfate accumulates in biota or contaminates the food chain (HSDB 1995).

CHEMICAL SUMMARY FOR STANNOUS CHLORIDE AND STANNOUS CHLORIDE AS TIN

These chemicals were identified by one or more suppliers as a bath ingredient for the electroless copper, non-formaldehyde electroless copper, and tin-palladium processes. This summary is based on information retrieved from a systematic search limited to secondary sources. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of stannous chloride are summarized below. The valence state of the stannous ion is 2 (Sn^{2+} or $\text{Sn}[\text{II}]$).

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF STANNOUS CHLORIDE		
Characteristic/Property	Data	Reference
CAS No.	7772-99-8	
Common Synonyms	tin (II) chloride tin dichloride tin protochloride	HSDB 1995
Molecular Formula	SnCl_2	
Chemical Structure	SnCl_2	
Physical State	crystals or flakes	Budavari et al. 1989
Molecular Weight	189.61	Budavari et al. 1989
Melting Point	246°C	Lide 1991
Boiling Point	652°C at 720 mm Hg	Lide 1991
Water Solubility	900 g/L at 20°C	HSDB 1995
Density	d^{25}_4 3.95	Lide 1991
Vapor Density (air = 1)	no data	
K_{oc}	no data	
Log K_{ow}	-2 to -3	Wong et al. 1982
Vapor Pressure	no data	
Reactivity	powerful reducing agent	Budavari et al. 1989
Flammability	not readily flammable	HSDB 1995
Flash Point	no data	
Dissociation Constant	no data	
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	3000 (inorganic tin) ^a	ATSDR 1992
Odor Threshold	odorless	HSDB 1995
Conversion Factors	not applicable	

a) Method of calculation/measurement not given.

II. ENVIRONMENTAL FATE

A. Environmental Release

No data on the release of stannous chloride to the environment were located in the secondary sources searched; environmental levels of tin are stated in terms of inorganic tin. Tin is a naturally-occurring element found in environmental media and natural foods. Tin and tin compounds are not included in the TRI. The most significant releases of inorganic tin are from burning of fossil fuels and industrial production and use of tin (ATSDR 1992). The tin content of airborne fly ash from coal-burning plants ranged from 7-19 $\mu\text{g/g}$ (ATSDR 1992). Tin in waste streams originates primarily from the production of tin cans (Brown 1983, as reported in HSDB 1995). Tin also occurs in water stored in coated metal containers and may be released in effluents from industrial processes and from municipal sewage (NRC 1977). Human exposure to tin is primarily by ingestion of canned food products (ATSDR 1992).

Public water supplies in 42 U.S. cities contained total tin at concentrations of 1.1-2.2 ug/L; water from 175 natural sources in west-central Arkansas contained 0.9-30 ug/L total tin (NRC 1977). Total tin was below the limit of detection in 56 of 59 samples of river water in the U.S. and Canada; the other three values were 1.3, 1.4, and 2.1 ug/L (NRC 1977). Seawater contains 0.2-0.3 $\mu\text{g/L}$ (NRC 1977). Tin occurs in surface and groundwater at 21% of NPL sites at a geometric mean concentration of 50 $\mu\text{g/L}$ (ATSDR 1992). Ambient soil levels in Canada ranged from 1-200 mg/kg total tin (mean 4 mg/kg); the ambient sediment level was 4.6 mg/kg (HSDB 1995). Tin was detected at hazardous waste sites at a geometric mean concentration of 30 mg/kg of soil (ATSDR 1992).

B. Transport

Tin released to the atmosphere in the form of particulates would be removed by gravitational settling within a matter of days. In soil, the Sn^{2+} cation will be adsorbed to some extent. Although moderately water soluble, tin in water may partition to soils and sediments; the Sn^{2+} ion will also readily precipitate as a sulfide or hydroxide (ATSDR 1992). These characteristics would limit mobility.

C. Transformation/Persistence

1. Air — Tin in the atmosphere is usually associated with dust particles; the deposition half-life of dust particles is on the order of days (U.S. EPA 1987c). No information on the transformation or degradation of inorganic tin compounds in the atmosphere was found.
2. Soil — The Sn^{2+} cation will be adsorbed by soil to some extent (ATSDR 1992), thereby retarding leaching to groundwater. The formation of insoluble salts would also limit the amount leaching to groundwater.
3. Water — Sn^{2+} in oxygen poor alkaline water will readily precipitate as a sulfide or hydroxide (ATSDR 1992); this would limit the amount in solution or suspension in groundwater. Inorganic tin may be transformed into organometallic compounds; a change of valence state probably does not occur (ATSDR 1992).
4. Biota — A log K_{ow} of -2 to -3 would indicate little potential for bioaccumulation, but reported estimates of the bioconcentration factors for inorganic tin (valence state not given) for marine and freshwater plants, invertebrates, and fish were 100, 1000, and 3000, respectively (ATSDR 1992).

CHEMICAL SUMMARY FOR SULFURIC ACID

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper, carbon, conductive polymer, graphite, non-formaldehyde electroless copper, and tin-palladium processes. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sulfuric acid are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SULFURIC ACID		
Characteristic/Property	Data	Reference
CAS No.	7664-93-9	
Common Synonyms	sulphuric acid; oil of vitriol	HSDB 1995
Molecular Formula	H ₂ SO ₄	Budavari et al. 1989
Chemical Structure	$ \begin{array}{c} \text{O} \\ \\ \text{HO} - \text{S} - \text{OH} \\ \\ \text{O} \end{array} $	
Physical State	clear, colorless, odorless, oily liquid	Budavari et al. 1989
Molecular Weight	98.08	Budavari et al. 1989
Melting Point	10°C (anhydrous acid)	Budavari et al. 1989
Boiling Point	about 290°C; decomposes at 340°C	Budavari et al. 1989
Water Solubility	miscible with water	Budavari et al. 1989
Density	1.84 (96-98% acid)	NIOSH 1994
Vapor Density (air = 1)	3.4 (at boiling point)	HSDB 1995
K _{oc}	no data	
Log K _{ow}	no data	
Vapor Pressure	5.933 x 10 ⁻⁵ @ 25 mm Hg	CHEMFATE 1995
Reactivity	strong dehydrating agent; reacts violently with water with evolution of heat; corrosive to metals	ACGIH 1991 ACGIH 1994-1995
Flammability	not flammable, but capable of igniting finely divided combustible materials	HSDB 1995
Flash Point	no data	
Dissociation Constant	K = 1.2 x 10 ⁻² ; pK = 1.92	HSDB 1995
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	1 mg/m ³	HSDB 1995
Conversion Factors	1.2 mg H ₂ SO ₄ contains 1 mg of SO ₃ ; 1 mg SO ₃ = 0.3 ppm; 1 ppm = 3.2 mg/m ³ @ 25°C, 760 mm Hg	Beliles and Beliles 1993

II. ENVIRONMENTAL FATE

A. Environmental Release

Sulfuric acid is a clear, colorless, odorless, oily liquid. It has a high affinity for water, abstracting it from the air and many organic substances. Sulfuric acid is produced in numerous grades and strengths. Commercial sulfuric acid contains 93-98% of acid; the remainder is water (Budavari et al. 1989). The primary sources of sulfuric acid in the atmosphere are vehicular emissions, combustion sources, explosive manufacture, furnace soot, sulfuric acid manufacture, and steel manufacture (U.S. EPA 1984d). Sulfuric acid occurs naturally in the vicinity of volcanoes, particularly in volcanic gases (HSDB 1995). Sulfur dioxide in moist air or fog combines with the water to form sulfurous

acid; the latter is slowly oxidized to sulfuric acid (Beliles and Beliles 1993). Based on rain chemistry data measured in southwestern Pennsylvania in 1983, an acid deposition budget was estimated as follows: 47%, sulfuric acid in rain; 23%, sulfur dioxide deposition without dew; 16%, nitric acid and sulfuric acid in fog and dew; and 0.5% aerosol dry deposition without dew (HSDB 1995).

Sulfuric acid can enter the aquatic environment from a variety of sources: in accidental spills from train derailments; in wastewaters from mining properties where sulfides are part of the ore or the rock being mined; in wastewaters from the steel industry; from the atmosphere; and as a decomposition product of effluents containing sulfur, thiosulfate, or thionates (HSDB 1995).

Sulfuric acid is the most widely used of the strong inorganic acids. Average occupational exposures to sulfuric acid mists in pickling, electroplating, and other acid treatment of metals are frequently above 0.5 mg/m³, while lower levels are usually found in the manufacture of lead-acid batteries and in phosphate fertilizer production (IARC 1992).

In 1992, releases of sulfuric acid to environmental media, as reported to the TRI by certain types of industries, totaled about 156,809,406 pounds. Of this amount, 23,721,453 pounds (15%) were released to the atmosphere, 32,719,526 pounds (21%) were released to surface water, 98,631,395 pounds (63%) were released in underground injection sites, and 1,737,032 pounds (1%) were released on land (TRI92 1994).

B. Transport

Sulfuric acid aerosols in the atmosphere are likely to be removed through wet and dry deposition. Released to soils, most of the sulfuric acid is expected to be removed by reaction with inorganic minerals or organic matter in soils. In highly sandy soil, sulfuric acid probably leaches into groundwater (U.S. EPA 1984d).

C. Transformation/Persistence

1. Air — Sulfuric acid is present in the atmosphere in the form of aerosols. In dry weather, the aerosol is found in the sub-0.65 μm particle size fraction, while under humid conditions, it is present in the 0.65-3.6 μm particle size range. Sulfuric acid is a primary source of inorganic sulfates in the atmosphere, particularly ammonium sulfate. Depending on the amount of moisture in the atmosphere, sulfuric acid aerosols may react with organics in the atmosphere to form sulfonates.
2. Soil — The majority of sulfuric acid in soils is expected to be removed by reaction with inorganic minerals or organic matter in soils. During transport through the soil, sulfuric acid can dissolve some of the soil material, in particular carbonate-based materials (HSDB 1995). In highly sandy soil, sulfuric acid probably leaches into groundwater (U.S. EPA 1984d).
3. Water — In aquatic media of about pH >7, sulfuric acid reacts with carbonate, bicarbonate, or hydroxides in the sediment or suspended particles, with the formation of sulfates. Since the majority of sulfates, with the exception of lead and calcium, are soluble in water, this reaction may mobilize the precipitated metals from the aquatic phase and decrease the pH of the solution. In aquatic media of pH <7, at least a part of the sulfuric acid may remain ionized in solution and may be mobile (U.S. EPA 1984d).
4. Biota — No information on the transformation/persistence of sulfuric acid in biota was found in the secondary sources searched.

CHEMICAL SUMMARY FOR TARTARIC ACID

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of tartaric acid are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF TARTARIC ACID		
Characteristic/Property	Data	Reference
CAS No.	87-69-4	
Common Synonyms	2,3-dihydroxybutanedioic acid; L-tartaric acid; Budavari et al. 1996; d-trataric acid; natural tartaric acid	Katz and Guest 1994, L-threonic acid; Informatics, Inc. 1974
Molecular Formula	C ₄ H ₆ O ₆	Budavari et al. 1996
Chemical Structure	HO ₂ CCH(OH)CH(OH)CO ₂ H	Lide 1991
Physical State	colorless or translucent solid monoclinic rhombic or spheroidal prisms, a white fine to granular crystalline powder	Lide 1991; Budavari et al. 1996
Molecular Weight	150.09	Informatics, Inc. 1974
Melting Point	171-174 °C; 168-170 °C	Lide 1991; Budavari et al. 1996
Boiling Point	no data	
Water Solubility	freely soluble (139 g/100 mL @ 20 °C)	Budavari et al. 1996
Density	1.7598 @ 20 °C	Lide 1991
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{OW} (= Log P _{oct})	Log P _{oct} -0.76/-2.02 (calculated) for the racemic threonic acid	Verschueren 1983
Vapor Pressure	no data	
Reactivity	no data	
Flammability	no data	
Flash Point	no data	
Dissociation Constant	pK _{a1} = 2.98, pK _{a2} = 4.34 pK _{a1} = 2.93, pK _{a2} = 4.23	Chapman and Hall 1996 Katz and Guest 1994, Budavari et al. 1996
Air Diffusivity Constant	no data	
Molecular Diffusivity Constant	no data	
Henry's Law Constant	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	odorless; odor of burnt sugar when heated to melting point	Informatics, Inc. 1974; Budavari et al. 1996
Conversion Factors	no data	

II. ENVIRONMENTAL FATE

A. Environmental Release

No information on environmental releases of tartaric acid was found in the secondary sources searched. Tartaric acid is widely used in foods, soft drinks, wine, cleaners, textile printing, pharmaceuticals, etc. and is freely water-soluble, so small quantities are likely to be released into the water supply, soil and eventually the groundwater from personal and commercial use and production.

B. Transport

No information on the environmental transport of tartaric acid was found in the secondary sources searched. Its high water solubility (139 g/100 mL @ 20°C; Budavari et al. 1996) suggests that if it did volatilize it could be removed from the atmosphere by rainfall, and if it were released onto soil it would likely be mobile and may end up in the groundwater.

C. Transformation/Persistence

1. Air – Tartaric acid is reported to be stable to air and light (Budavari et al. 1996); no other information was found in the secondary sources searched.
2. Soil – No information regarding the transformation/persistence of tartaric acid in soil was located. Its high water solubility suggests it would be highly mobile in soil and could enter the groundwater.
3. Water – No information on the transformation/persistence of tartaric acid in water was found in the secondary sources searched. Being a strong organic acid (Budavari et al. 1996), it is expected to dissociate into its ion components when in water.
4. Biota – No information on the transformation/persistence of tartaric acid in the biota was found in the secondary sources searched. Its high water solubility indicates that it would not appreciably bioconcentrate in the flora or fauna.

CHEMICAL SUMMARY FOR TETRASODIUM EDTA (Na₄EDTA)

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of Na₄EDTA are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF Na ₄ EDTA		
Characteristic/Property	Data	Reference
CAS No.	64-02-8	
Common Synonyms	(ethylenedinitrilo)tetraacetic acid tetrasodium salt; edetate sodium; edetic acid tetrasodium salt; EDTA tetrasodium salt; Trilon B; Versene 100; Versene beads or flake	HSDB 1995
Molecular Formula	C ₁₀ H ₁₆ N ₂ O ₈ .4Na	HSDB 1995
Chemical Structure		
Physical State	white powder; anhydrous or 2H ₂ O	HSDB 1995
Molecular Weight	380.20	HSDB 1995
Melting Point	not found	
Boiling Point	not found	
Water Solubility	103 g/100 mL; very soluble	HSDB 1995
Density	6.9 lb/gal	HSDB 1995
Vapor Density (air = 1)	not found	
K _{oc}	not found	
Log K _{ow}	not found	
Vapor Pressure	0.24 x 10 ² torr @ 25°C	CHEMFATE 1995
Reactivity	reacts with most divalent and trivalent metallic ions to form soluble metal chelates	HSDB 1995
Flammability	not found	
Flash Point	not found	
Dissociation Constant	not found	
Henry's Law Constant	not found	
Molecular Diffusivity Coefficient	not found	
Air Diffusivity Coefficient	not found	
Fish Bioconcentration Factor	not found	
Odor Threshold	not found	
Conversion Factors	1 ppm = 16.7 mg/m ³ 1 mg/m ³ = 0.064 ppm	Calculated using: ppm = mg/m ³ x 24.45/m.w.

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found in the secondary sources searched regarding the environmental release of Na₄EDTA. The chemical is probably released to air, water, and soil from industries that manufacture and use it, from the use of pesticide formulations that contain it, and from the disposal of pharmaceuticals and other consumer products that contain it.

B. Transport

No information was found in the secondary sources searched regarding the environmental transport of Na₄EDTA. The vapor pressure for Na₄EDTA (0.24 x 10² torr [CHEMFATE 1995]) suggests that the chemical is moderately volatile and may undergo volatilization from soil and water surfaces. The high water solubility of Na₄EDTA suggests possible leaching of the chemical through the soil to groundwater.

C. Transformation/Persistence

1. Air — Estimated half-lives for the reaction of Na₄EDTA with RO₂, OH, and O₃ are 2200 years, 8 minutes, and 1 day, respectively (CHEMFATE 1995). This suggests that Na₄EDTA in the atmosphere may undergo significant reaction with photochemically-generated hydroxyl radicals and ozone.
2. Soil — Na₄EDTA released to the soil would form soluble metal chelates with most divalent and trivalent metallic ions (HSDB 1995).
3. Water — The reaction of Na₄EDTA with OH in air (CHEMFATE 1995) suggests that the chemical may also react with photochemically-generated hydroxyl radicals in water.
4. Biota — No information was found in the secondary sources searched regarding the persistence or biomagnification of Na₄EDTA in biota.

CHEMICAL SUMMARY FOR TRIETHANOLAMINE

This chemical was identified by one or more suppliers as a bath ingredient for the electroless copper and tin-palladium processes. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of triethanolamine are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF TRIETHANOLAMINE		
Characteristic/Property	Data	Reference
CAS No.	102-71-6	
Common Synonyms	2,2',2''-nitrilotrisethanol	CHEMFATE 1995
Molecular Formula	$C_6H_{15}NO_3$	
Chemical Structure	$(HOCH_2CH_2)_3N$	
Physical State	pale yellow, viscous liquid	Benya and Harbison 1994
Molecular Weight	149.19	CHEMFATE 1995
Melting Point	21.57°C	CHEMFATE 1995
Boiling Point	335.4°C	CHEMFATE 1995
Water Solubility	miscible	CHEMFATE 1995
Density	$d^{20/4}$, 1.1242	HSDB 1995
Vapor Density (air = 1)	5.1	HSDB 1995
K_{oc}	no data	
Log K_{ow}	-1.59	CHEMFATE 1995
Vapor Pressure	3.59×10^{-6} mm Hg at 25°C	CHEMFATE 1995
Reactivity	may become unstable at elevated temperatures and pressure	HSDB 1995
Flammability	must be heated before ignition will occur	HSDB 1995
Flash Point	190.5°C (open cup)	HSDB 1995
Dissociation Constant (pKa)	7.92	CHEMFATE 1995
Henry's Law Constant	3.38×10^{-19} atm-m ³ /mol (estimated)	CHEMFATE 1995
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	<1 (estimated)	
Odor Threshold	<3.9 (measured; species not given)	HSDB 1995
Conversion Factors	no data; slight ammoniacal odor	HSDB 1995
	1 ppm = 6.10 mg/m ³	Calculated using the
	1 mg/m ³ = 0.164 ppm	formula: ppm =
		mg/m ³ (24.45/mol. wt)

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found in the secondary sources searched to indicate the specific amount of triethanolamine released to the environment in any given year. Approximately 100,000 - 500,000 tons/year of the chemical are produced worldwide (U.S. EPA 1995b). Although the production of triethanolamine is tightly controlled, a worst case estimation of production loss by industry to the environment is 0.5%. Release can also occur during the use of the chemical as a metal working/cutting fluid, as an additive to cement, as an intermediate in surfactant production, or in the manufacture of textile auxiliaries (U.S. EPA 1995b).

B. Transport

Because of the high water solubility and low octanol-water coefficient of triethanolamine, the chemical will likely partition into water. Although no data were found for the K_{ow} , adsorption onto soils is unlikely and leaching of the chemical into ground water is expected. The low vapor

pressure and low Henry's Law Constant indicate that volatilization to the atmosphere will be negligible.

C. Transformation/Persistence

1. Air — The half-life for triethanolamine reaction with photochemically produced hydroxy radicals was estimated at 4 hours with a rate constant of 10.4×10^{-11} cm³/molecules-sec and assuming an average hydroxyl concentration of 5×10^5 molecules/cm³ (HSDB 1995). The chemical will also be removed from the atmosphere in precipitation (HSDB 1995).
2. Soil — Triethanolamine will be biodegraded rapidly in soils, following acclimation, with a half-life of days to weeks. Removal from soils also occurs through leaching (HSDB 1995).
3. Water — Triethanolamine is rapidly degraded in water following acclimation. In a batch system using activated sludge, the chemical was 89% degraded in 14 days following a 3 day acclimation period (CHEMFATE 1995). Other tests showed increases in theoretical biological oxygen demand (BODT) of 66% and 69% (sea water) in 20 days using sewage inoculum (CHEMFATE 1995; HSDB 1995).
4. Biota — Based on the low estimated bioconcentration factor and high water solubility of triethanolamine, the chemical is expected to have a low potential for bioaccumulation in aquatic organisms.

CHEMICAL SUMMARY FOR SODIUM CITRATE

This chemical was identified by one or more suppliers as a bath ingredient for the organic-palladium process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of sodium citrate are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF SODIUM CITRATE		
Characteristic/Property	Data	Reference
CAS No.	68-04-2	
Common Synonyms	trisodium citrate; sodium citrate anhydrous; 2-hydroxy-1,2,3-propanetricarboxylic acid, trisodium salt	Lockheed Martin 1991
Molecular Formula	$C_6H_5Na_3O_7$	Budavari et al. 1989
Chemical Structure	$CH_2(COONa)C(OH)(COONa)CH_2COONa$	Osol 1980
Physical State	dihydrate, white crystals, granules, or powder; pentahydrate, relatively large, colorless crystals or white granules	Budavari et al. 1989
Molecular Weight	258.07	Budavari et al. 1989
Melting Point	150 °C (-2 H ₂ O)	Fisher Scientific 1985
Boiling Point	decomposed at red heat	Lewis 1993
Water Solubility	72 g/100 mL at 25 °C (dihydrate)	Weast 1983-1984
Density	1.9	Fisher Scientific 1985
Vapor Density (air = 1)	no data	
K _{oc}	no data	
Log K _{ow}	no data	
Vapor Pressure	no data	
Reactivity	0 (nonreactive, NFPA classification); aqueous solution slightly acid to litmus	Lockheed Martin 1991 Osol 1980
Flammability	1 (slightly combustible, NFPA classification);	Lockheed Martin 1991
Flash Point	no data	
Dissociation Constant	no data	
Henry's Law Constant	no data	
Molecular Diffusivity Coefficient	no data	
Air Diffusivity Coefficient	no data	
Fish Bioconcentration Factor	no data	
Odor Threshold	no data; odorless	Lewis 1993
Conversion Factors	no data	

II. ENVIRONMENTAL FATE

A. Environmental Release

Sodium citrate is a solid with a cool, saline taste that is soluble in water (Fisher Scientific 1985). It is used in soft drinks, frozen desserts, meat products, cheeses, and as a nutrient for cultured buttermilk; in photography; in detergents; as a sequestrant and buffer; as an anticoagulant for blood withdrawn from the body; and in the removal of sulfur dioxide from smelter waste gases (Lewis 1993). Medicinally, sodium citrate is used as expectorant and systemic alkalizer. Sodium citrate is a chelating agent and has been used to facilitate elimination of lead from the body (Osol 1980).

APPENDIX C

No data were found on the environmental releases of sodium citrate. The chemical is not listed on U.S. EPA's TRI, requiring certain U.S. industries to report on chemical releases to the environment (TRI93 1995). The chemical could potentially enter the environment when used for the removal of sulfur dioxide from smelter waste gases.

B. Transport

No data were found on the environmental transport of sodium citrate in the secondary sources searched. Its water solubility suggests that the sodium citrate would remain in the water phase.

C. Transformation/Persistence

No data were found on the transformation/persistence of potassium bisulfate in the secondary sources searched.

CHEMICAL SUMMARY FOR VANILLIN

This chemical was identified by one or more suppliers as a bath ingredient for the tin-palladium process. This summary is based on information retrieved from a systematic search limited to secondary sources (see Attachment C-1). The only exception is summaries of studies from unpublished TSCA submissions that may have been included. These sources include online databases, unpublished EPA information, government publications, review documents, and standard reference materials. No attempt has been made to verify information in these databases and secondary sources.

I. CHEMICAL IDENTITY AND PHYSICAL/CHEMICAL PROPERTIES

The chemical identity and physical/chemical properties of vanillin are summarized below.

CHEMICAL IDENTITY AND CHEMICAL/PHYSICAL PROPERTIES OF VANILLIN		
Characteristic/Property	Data	Reference
CAS No.	121-33-5	
Common Synonyms	4-hydroxy-3-methoxybenzaldehyde; methyl-protocatechuic aldehyde; vanillic aldehyde; 3-methoxy-4-hydroxybenzaldehyde	Budavari et al. 1996
Molecular Formula	$C_8H_8O_3$	
Chemical Structure	$(CH_3O)C_6H_3(OH)CHO$	Kirwin and Galvin 1993
Physical State	white or slightly yellow needles	Budavari et al. 1996
Molecular Weight	152.15	Budavari et al. 1996
Melting Point	80-81 °C	Budavari et al. 1996
Boiling Point	285 °C	Budavari et al. 1996
Water Solubility	1 g/100 mL	Budavari et al. 1996
Density	1.056 g/mL	Budavari et al. 1996
Vapor Density (air = 1)	5.2	HSDB 1996
K_{oc}	not found	
Log K_{ow}	not found	
Vapor Pressure	2.2×10^{-3} mm Hg @ 25 °C	HSDB 1996
Reactivity	can react violently with bromine, potassium tert-butoxide, tert-chlorobenzene + NaOH, formic acid + $Tl(NO_3)_3$ and perchloric acid	Keith and Walters 1985
Flammability	not found	
Flash Point	not found	
Dissociation Constant	pK_{a1} 7.40, pK_{a2} 11.4 (25 °C)	Chapman and Hall 1995
Henry's Law Constant	not found	
Molecular Diffusivity Coefficient	not found	
Air Diffusivity Coefficient	not found	
Fish Bioconcentration Factor	not found	
Odor Threshold	2×10^{-1} ppm, water; 1.10×10^{-8} ppb, air	Kirwin and Galvin 1993
Conversion Factors	1 ppm = 6.2 mg/m ³ 1 mg/m ³ = 0.161 ppm	Brabec 1993

II. ENVIRONMENTAL FATE

A. Environmental Release

No information was found in the secondary sources searched regarding the environmental release of vanillin. The chemical occurs naturally in vanilla, potato parings, and Siam benzoin (Budavari et al. 1996).

B. Transport

No information was found in the secondary sources searched regarding the environmental transport of vanillin. The vapor pressure (2.2×10^{-3} mm Hg [HSDB 1996]) for the chemical indicates that little volatilization from soil or water could occur. Vanillin is soluble in water (1 g/100 mL [Budavari et al. 1996]) and may move through the soil, possibly to groundwater.

C. Transformation/Persistence

1. Air — Vanillin oxidizes to some extent when exposed to moist air and is "affected" by light (Budavari et al. 1996). Vanillin absorbs UV light at wavelengths of 308 and 278 nm (Kirwin and Galvin 1993), suggesting that phototransformation is possible. Decomposition of vanillin under strict anaerobic conditions has been observed (HSDB 1996).
2. Soil — No information was found in the secondary sources searched regarding the fate of vanillin in soil.
3. Water — No information was found in the secondary sources searched regarding the fate of vanillin in the aquatic environment. Based on its absorption of UV light at wavelengths of 308 and 278 nm, vanillin in surface water could undergo some phototransformation.
4. Biota — No information was found in the secondary sources searched regarding the bioaccumulation of vanillin.

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